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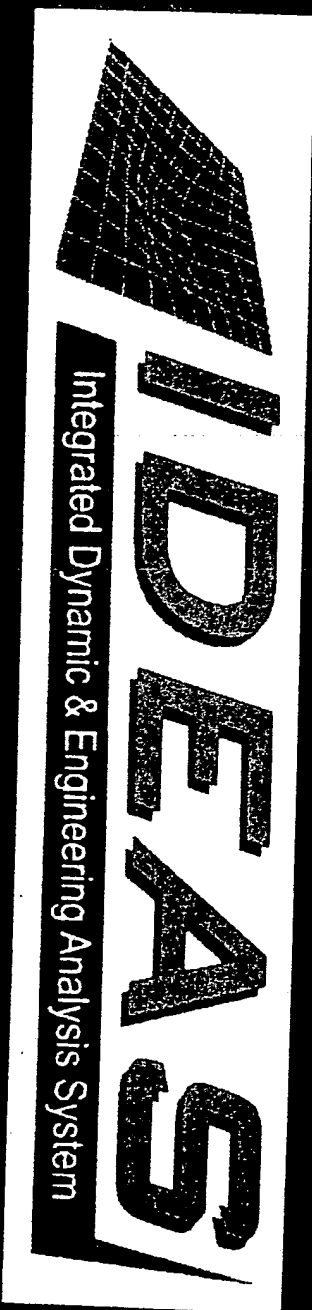
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IDEAS™ Program Launched June '97



TM



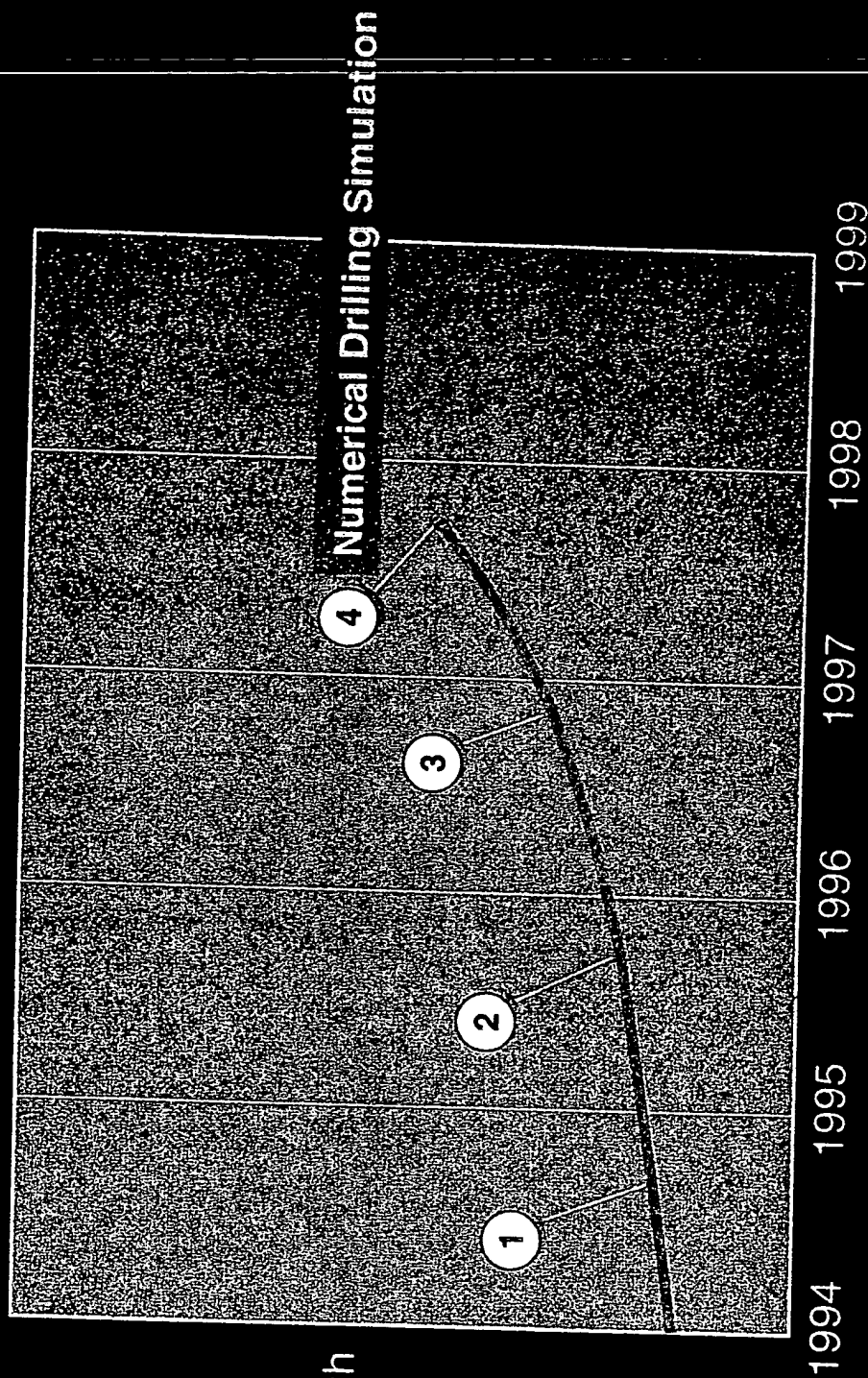
SMITH TOOL

A Business Unit of Smith International, Inc.

Smith Tool Engineering R&D

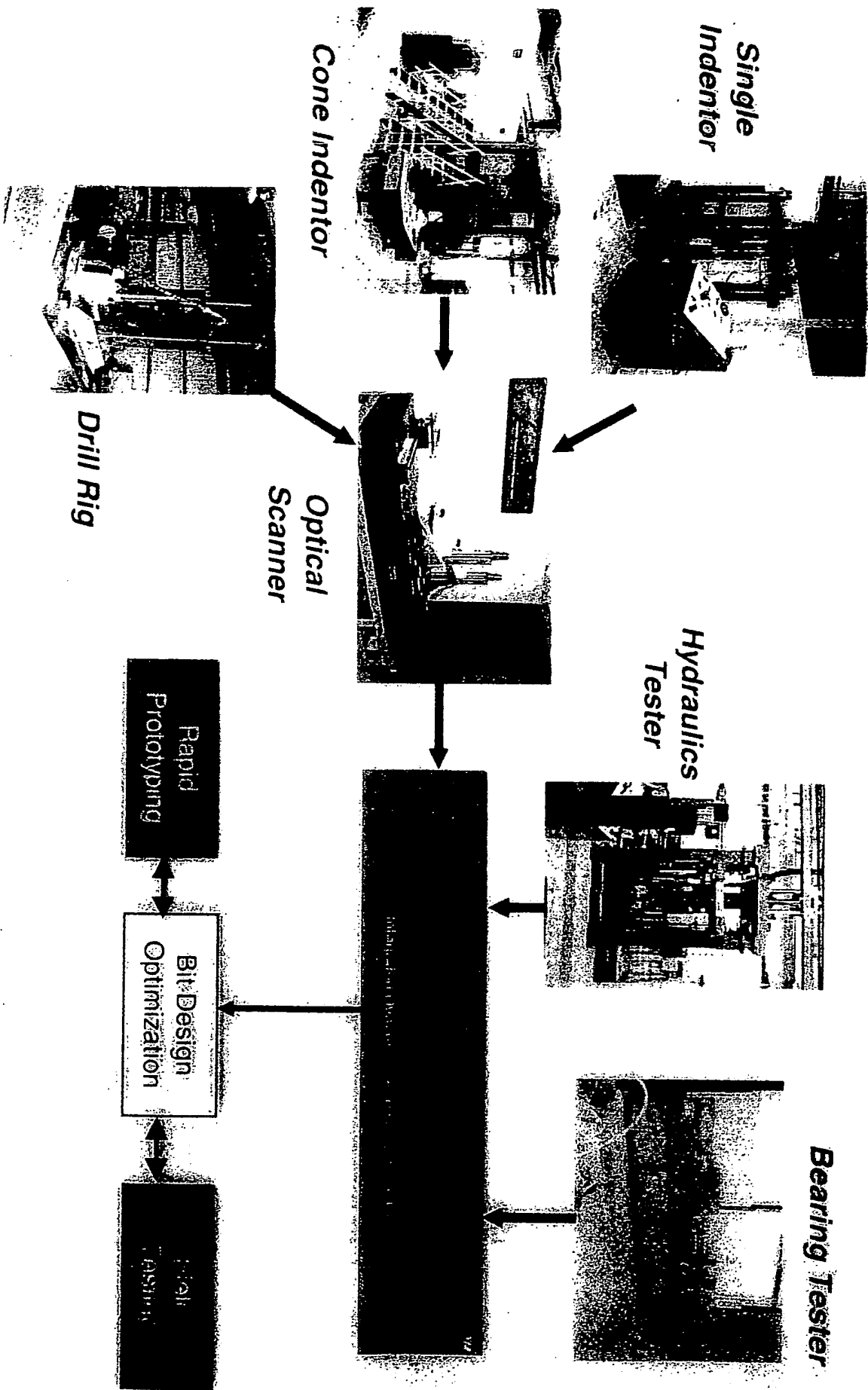


Breakthrough
Technical
Capacity



SMITH TOOL
A Business Unit of Smith International, Inc.

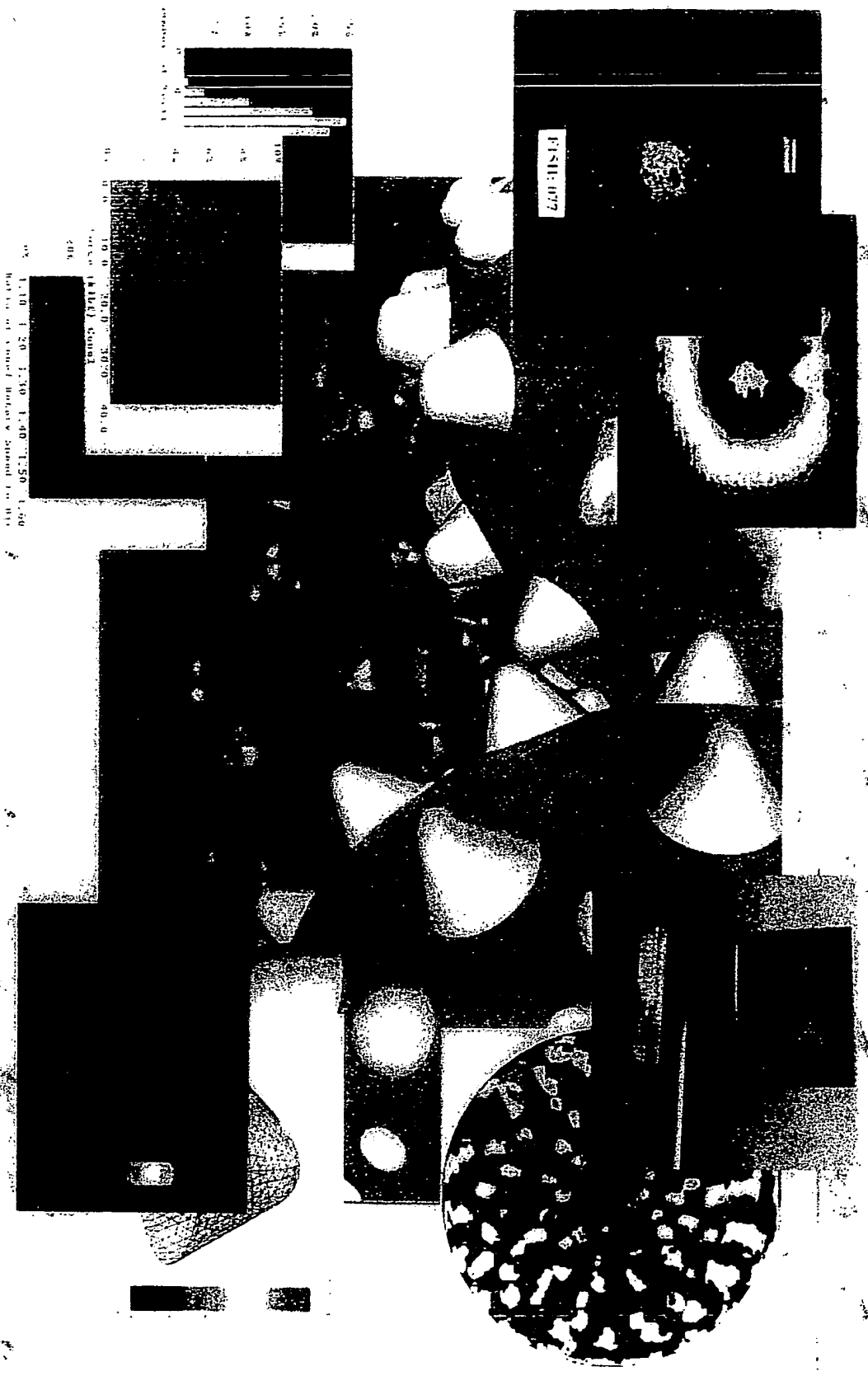
Figure 1. The relationship between the number of species and the number of genera in the family *Chrysomelidae* (Coleoptera: Chrysomelidae) in the Iberian Peninsula. The data are from the Catalogue of the Coleoptera of the Iberian Peninsula (Carrion et al., 2001).



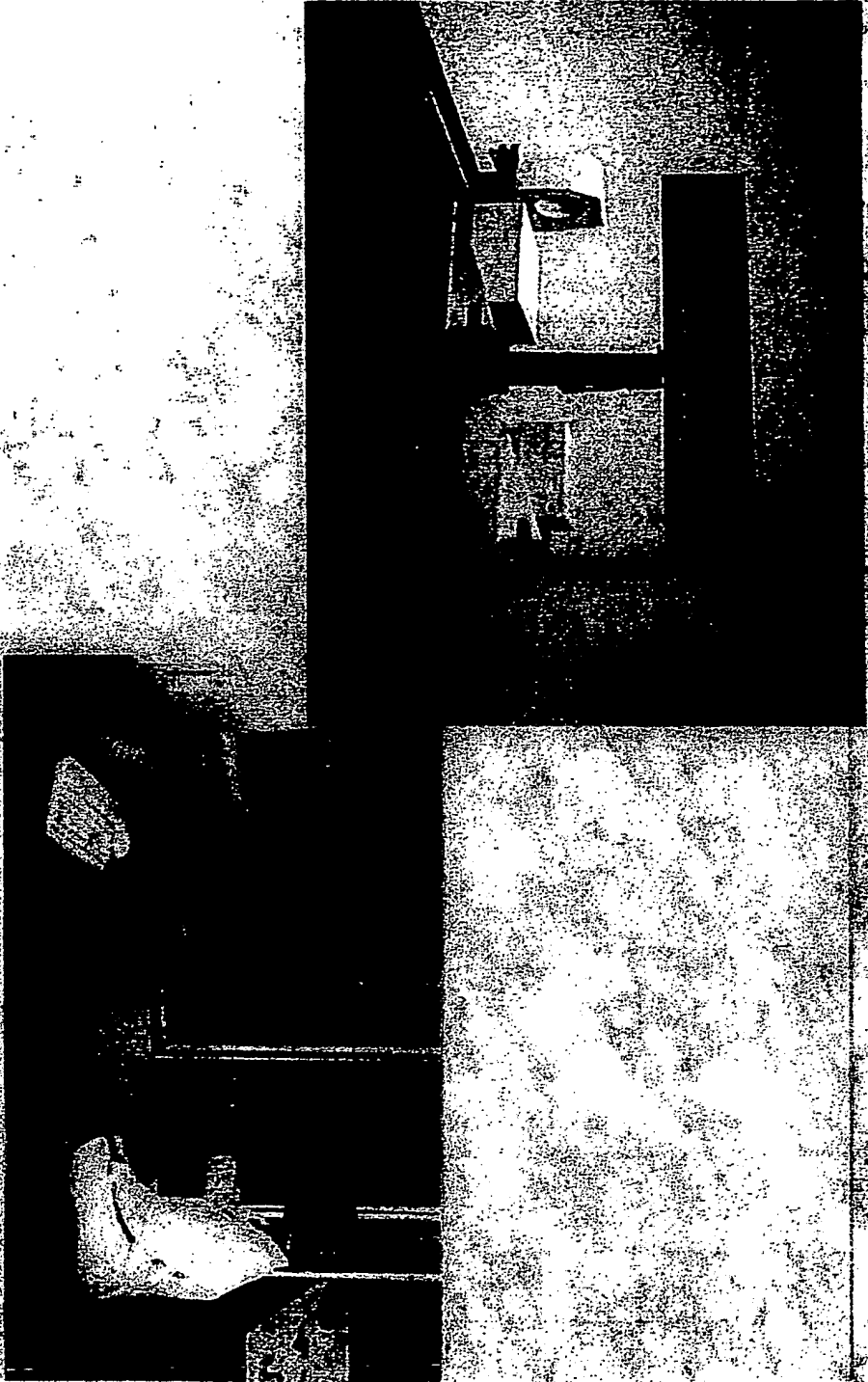




IDEASTM Process Methodology



Rock Bit Drilling Laboratory July '98



The Goal

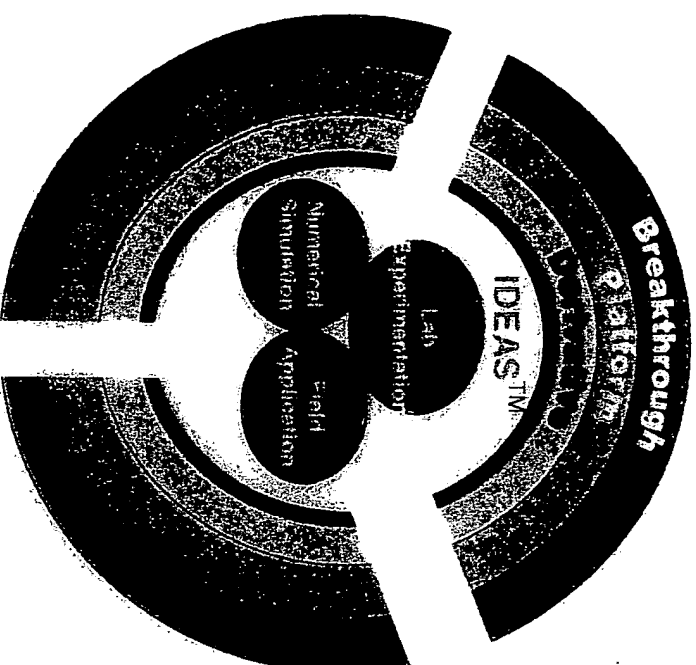
- ◆ Enable the Engineers to design rock bits in a virtual environment that simulates actual drilling conditions
- ◆ Provide the Engineers with a learning tool to increase their profound knowledge
- ◆ Increase our technical image with our customers



Process Dynamics

Technical
Differentiation

Customer
Confidence



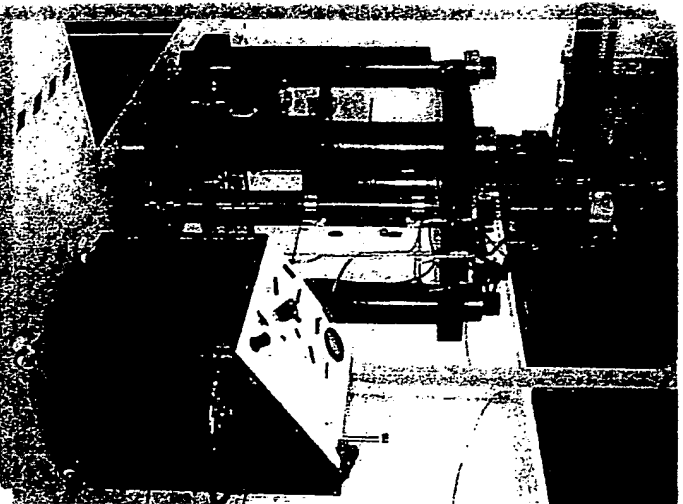
Learning
Organization

- ✓ IDEAS IS NOT a software program or a piece of equipment
- ✓ IDEAS IS a systematic, comprehensive approach to engineering rock bits (a philosophy)

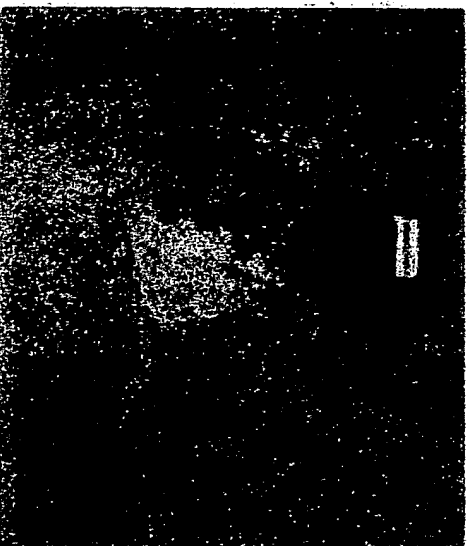


Cutting Structure Development Tools

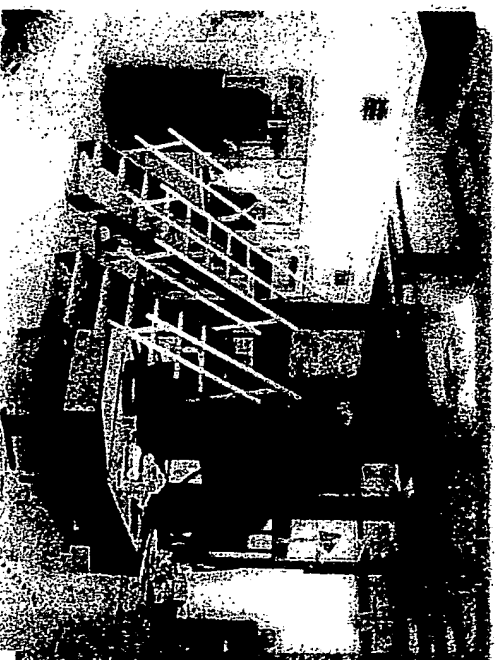
- Rock Crater Indentation



Single Indentor



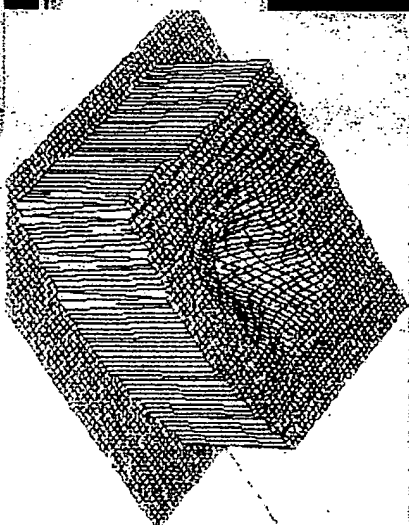
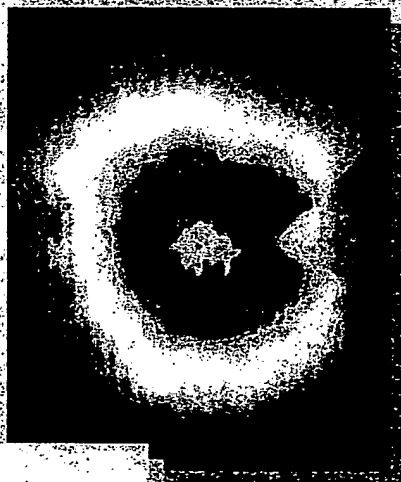
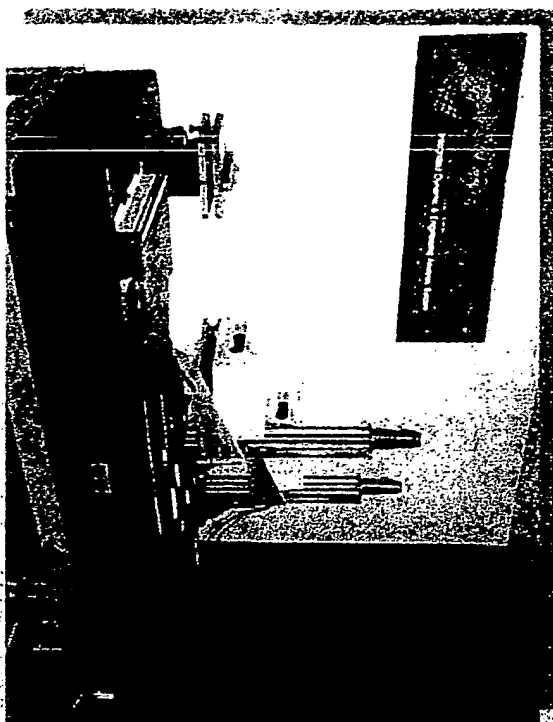
Cone Indentor



Crater Formation

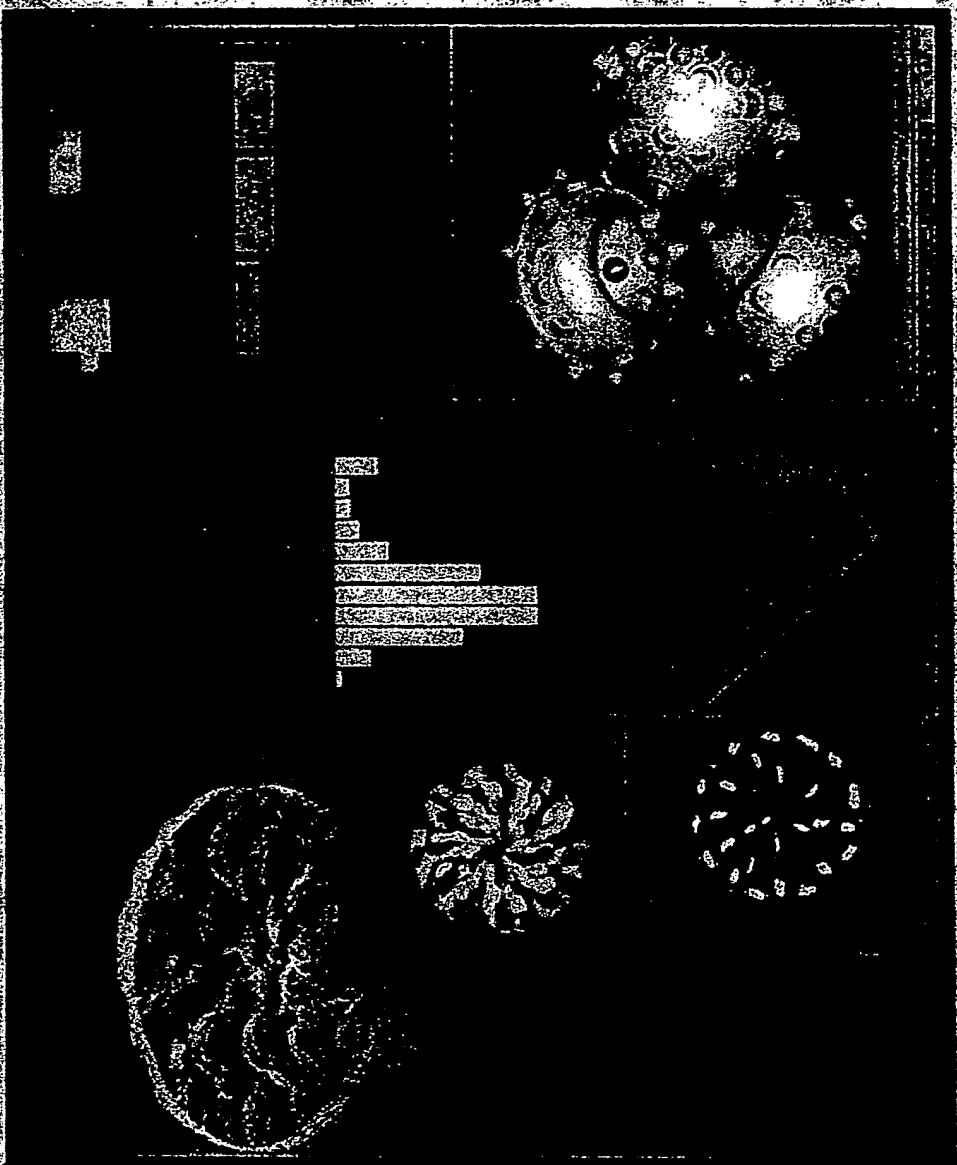
Cutting Structure Development Tools

- Digitizing and Analysis



Cutting Structure Development Tools

- *Digitizing and Analysis*





Ideas Bit Design Process

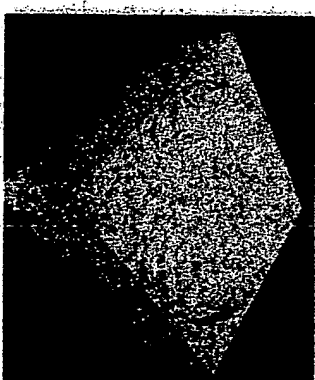
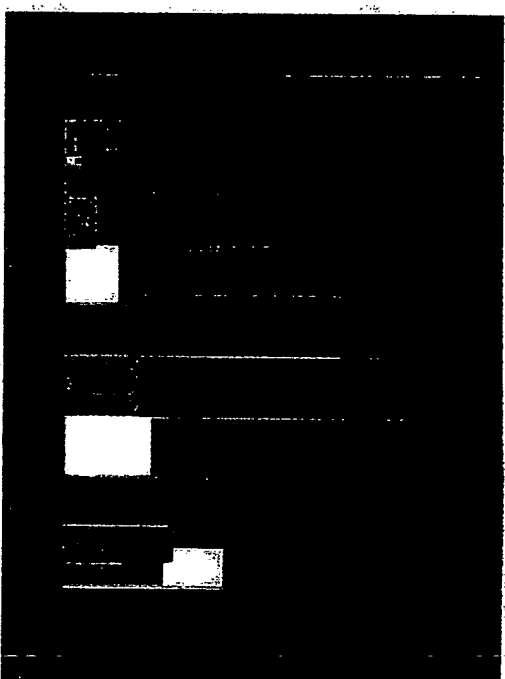
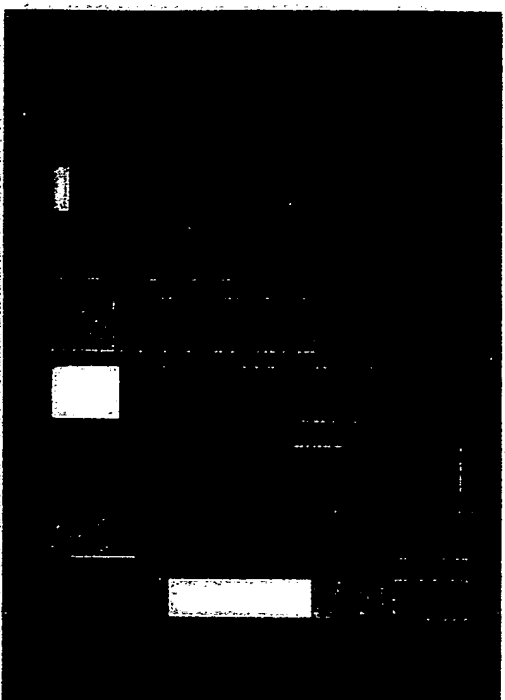
- Understand the targeted bit application and performance in the field
- Run the insert indentation tests
- Analyze the baseline bit by IDEAS[™] and define the problems of the bit
- Design and optimize a new bit by using IDEAS[™]



Bit Optimization

Bottom Hole Pattern

- 1) Bottom hole coverage efficiency (insert/row locations, counts)

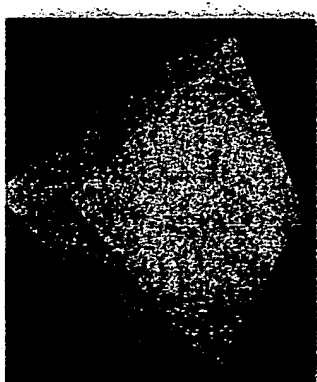
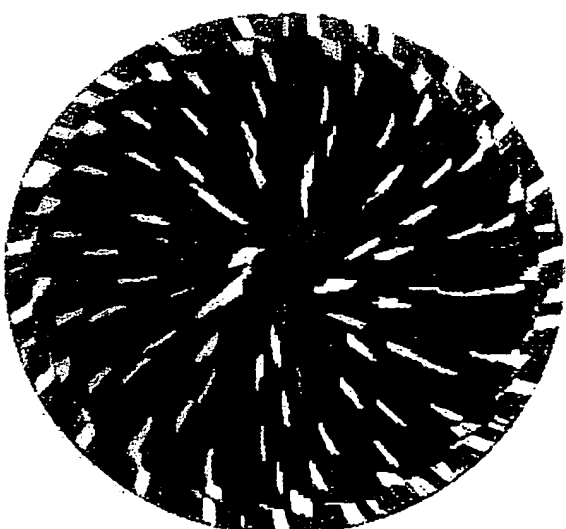
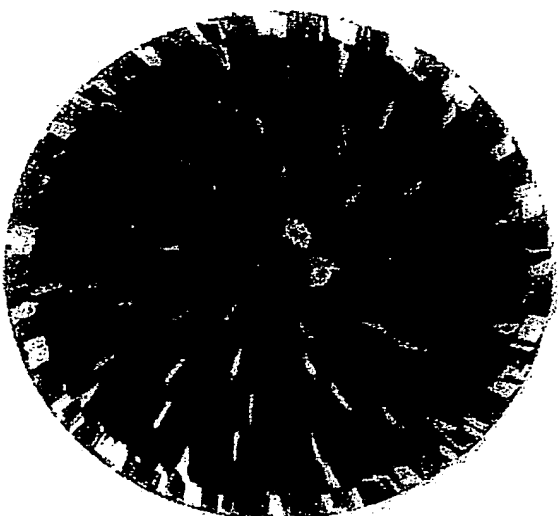




Bit Optimization

Bottom Hole Pattern

2) Inserts tracking pattern (profile, pitch break)





Initial Product Launch Objectives

A differentiable line of premium proprietary products capable of consolidating and improving market shares in key targeted U.S. and Canadian markets by increasing ROP (10-20%), improved footage and more consistent dull conditions

Performance improvements should be managed to enable second and third phase gains to be made

Integrate Engineering into target benchmarking and verification process

North American launch targeted by end of 2000



IDEAS™ Bit Design: 7 7/8 ER57/54



- Increased bit offset .219 vs. .188
- Unique gage configuration
- Aggressive profile with increased bottom hole coverage
- Sharper inner row insert
- Balanced cone-bit ratios
- Vertical force balanced
- Bottom hole pattern optimization

IDEAS™ Bit Design: 7 7/8 ER 5754

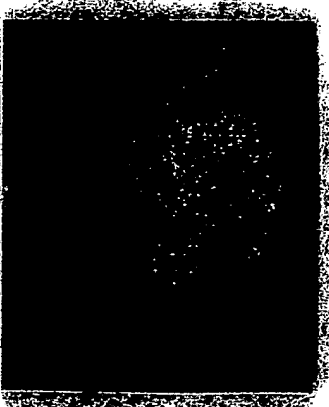
STD FISH ER 5754

WOB	42k	42k
RPM	85	85
Rop/ideas	23.44	38.7
Rock Type	Shale	Shale
Bit Coverage	38%	42%
Bit Offset	.188	.219
Insert Count	104	130
Row Count	11	13
Insert Ext.	.37	.38





Bit Optimization



- Profile design
- Bottom hole pattern
- Insert sharpness, shape, counts and wear resistance
- Gage inserts configuration and efficiency
- General bit geometry



Bit Optimization

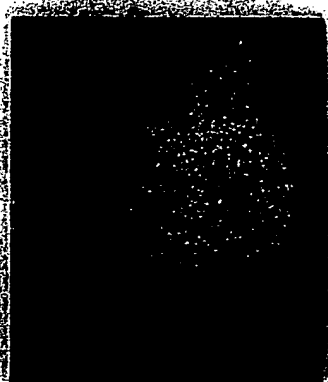
- Profile design

- Bottom hole pattern

- Insert sharpness, shape, counts and wear resistance

- Gage inserts configuration and efficiency

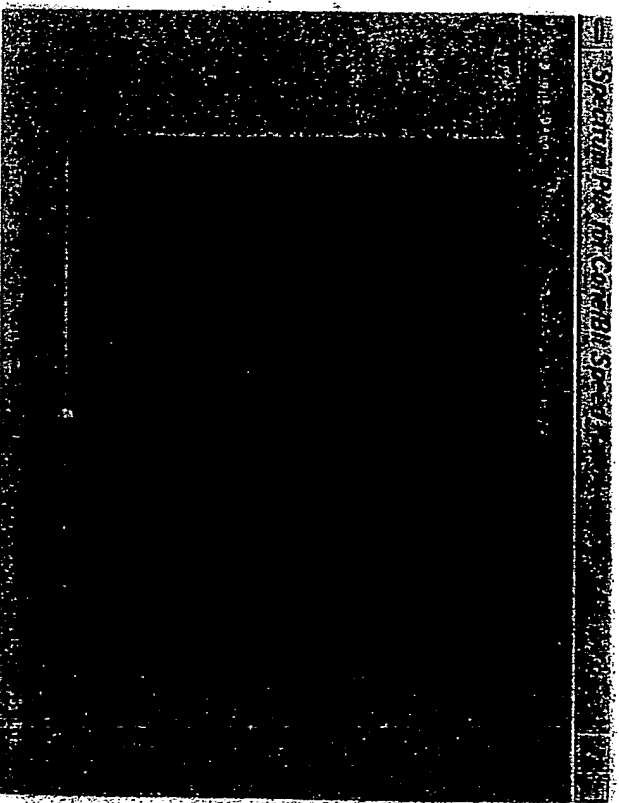
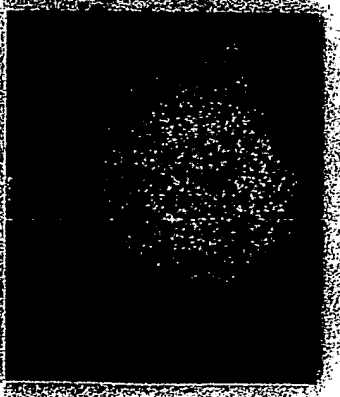
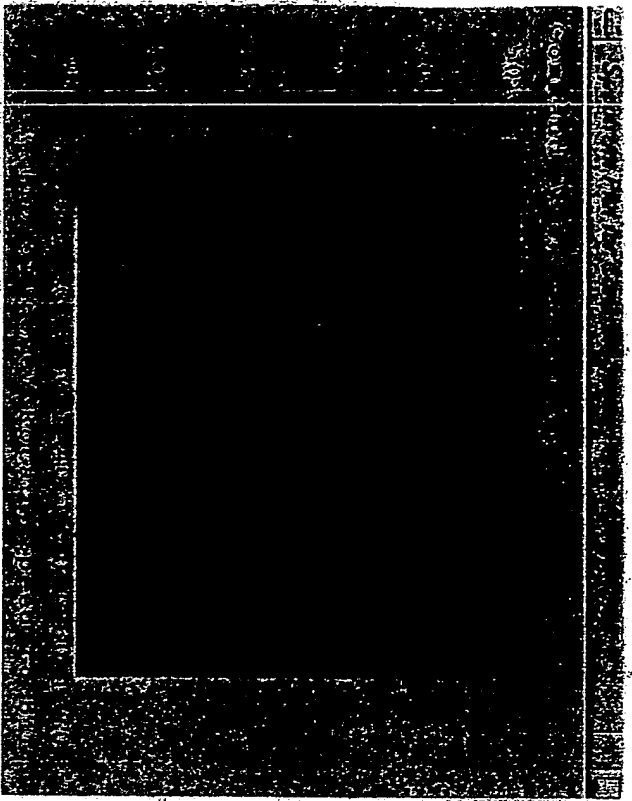
- General bit geometry





Bit Optimization

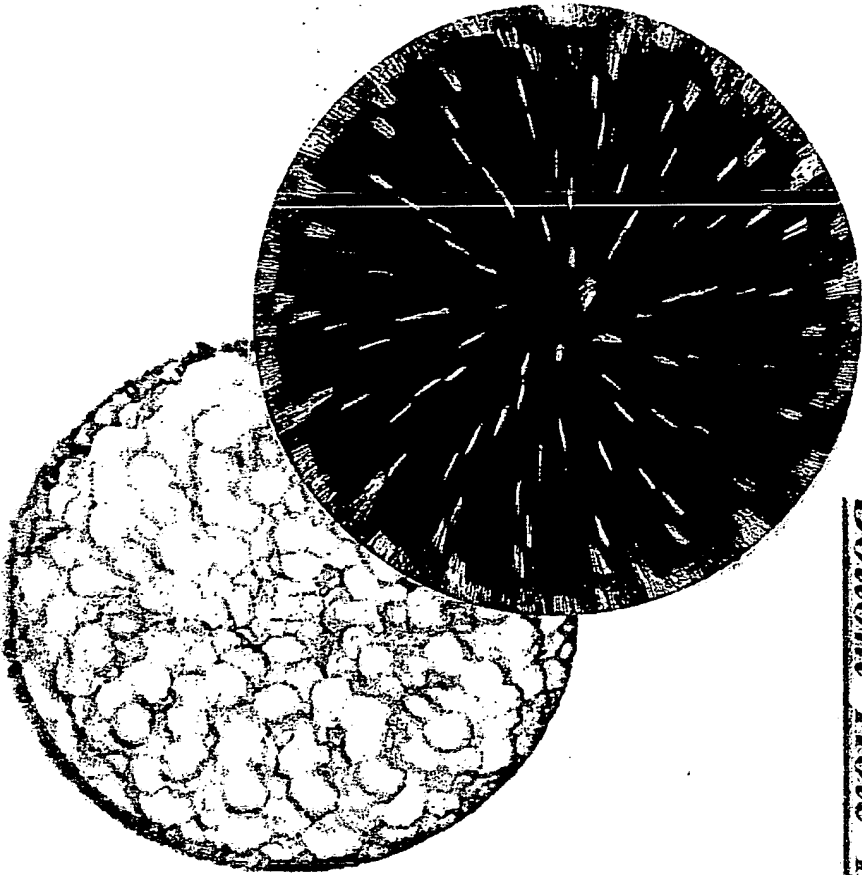
Bit/Cone Rotation Ratio



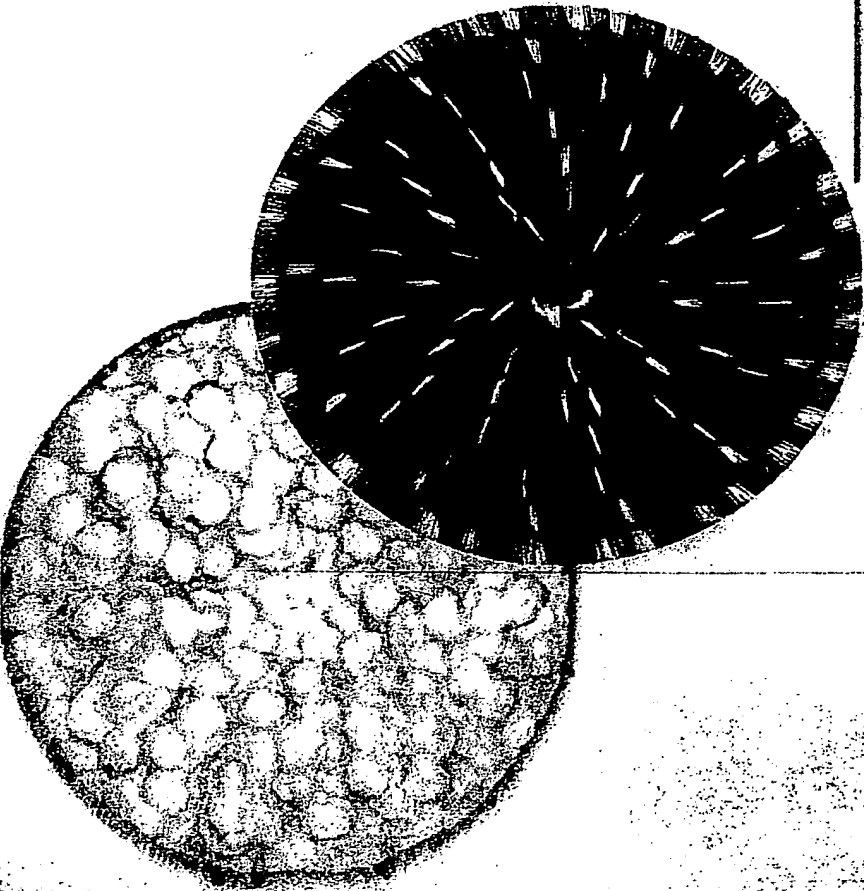


IDEASTM Bit Design: 7 7/8 IR5754

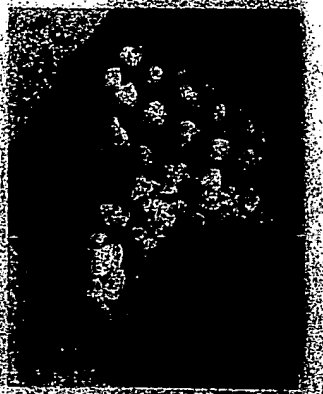
Bottom Hole Patterns



IR 5754



Standard 7 7/8 IR1514

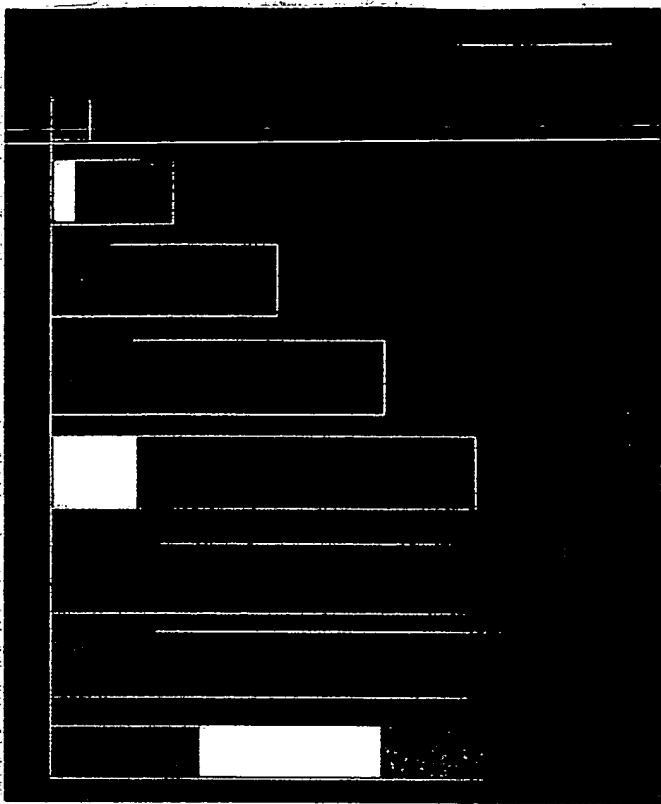




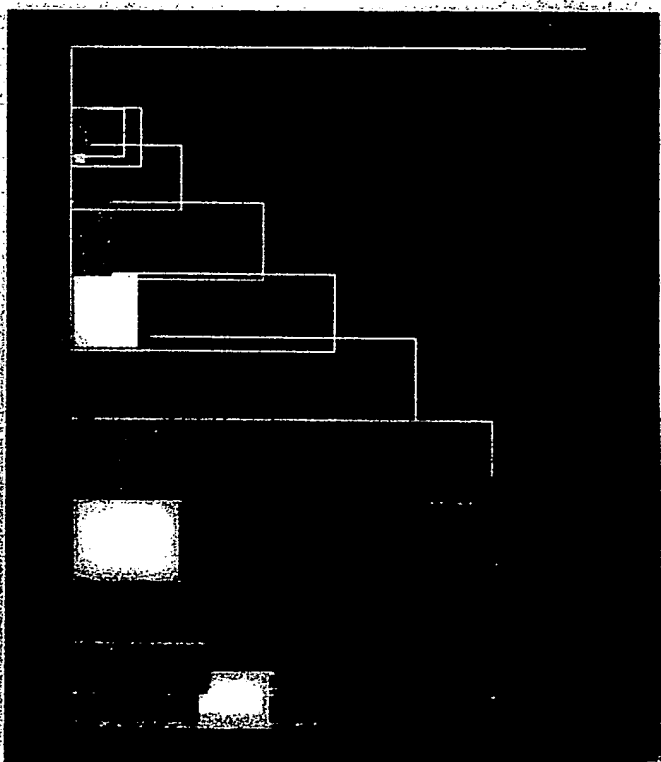
IDEAS™ Bit Design: 7 7/8 ER 5754



Bottom Hole Coverage Pattern



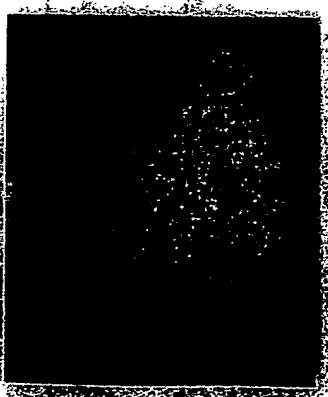
STD 7 7/8 ER 5754



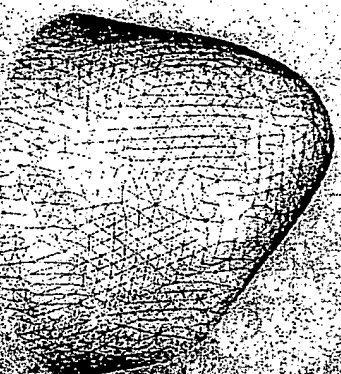
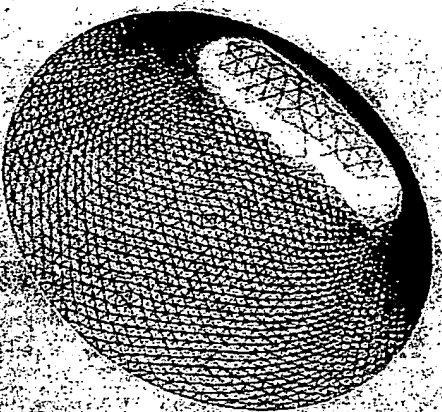
ER 5754



Bit Optimization

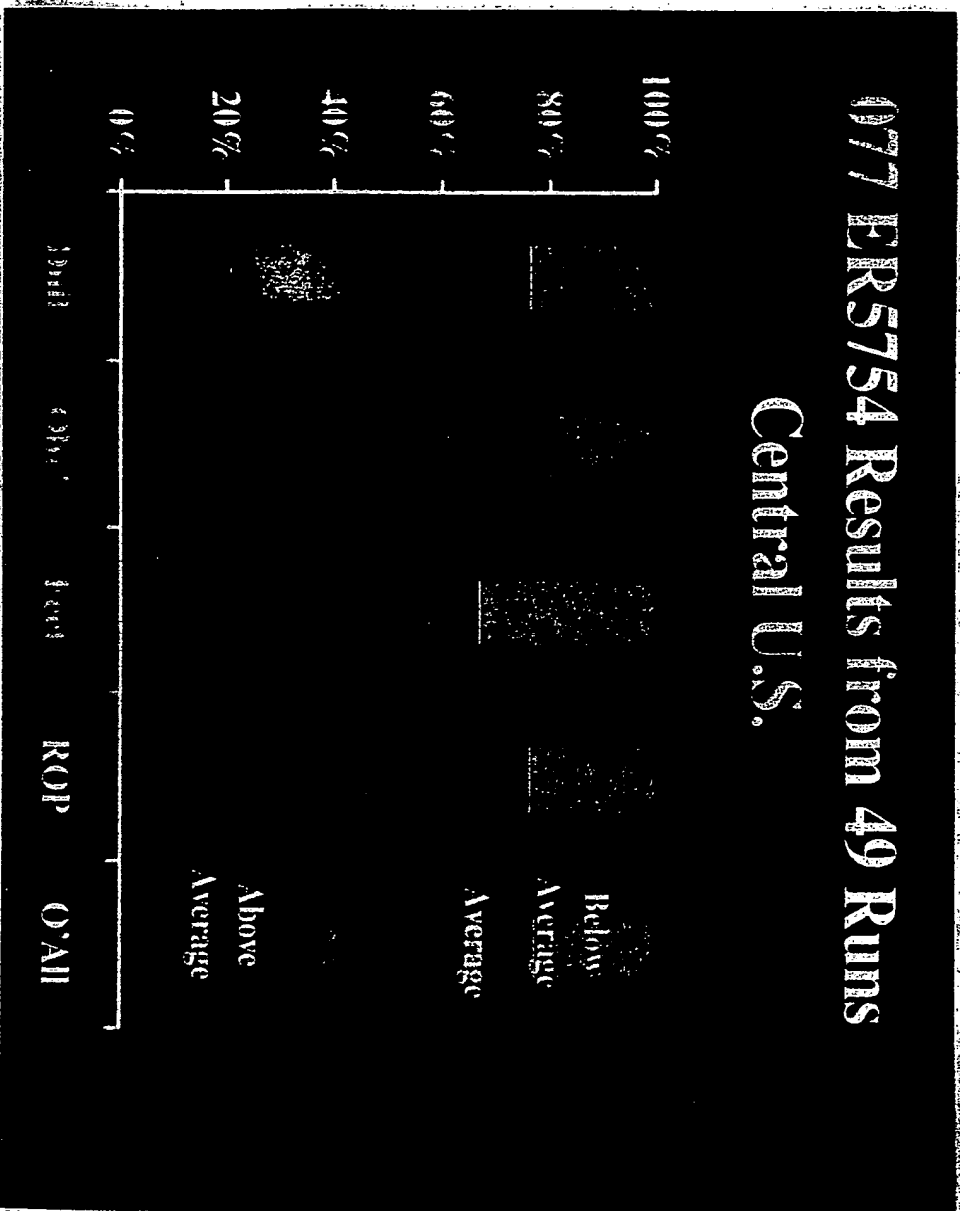


Insert Sharpness, Shape, Counts And Wear Resistance



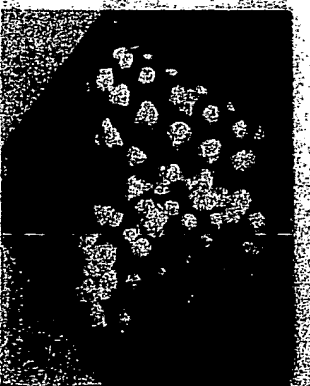
IDEAS™ Bit Design: 7 7/8 ER5754

077 ER5754 Results from 49 Runs Central U.S.





IDEASTM Bit Design: 7 7/8 ER5754



077 ER5754 results from 14 runs
Rocky Mountain Region

1000 %
800 %
600 %
400 %
200 %
0 %

1000

800

600

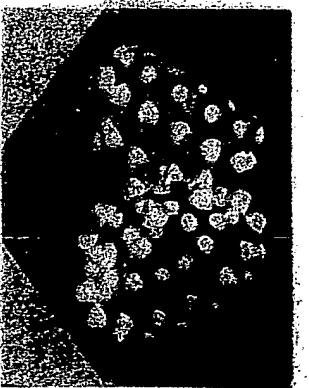
400

200

0

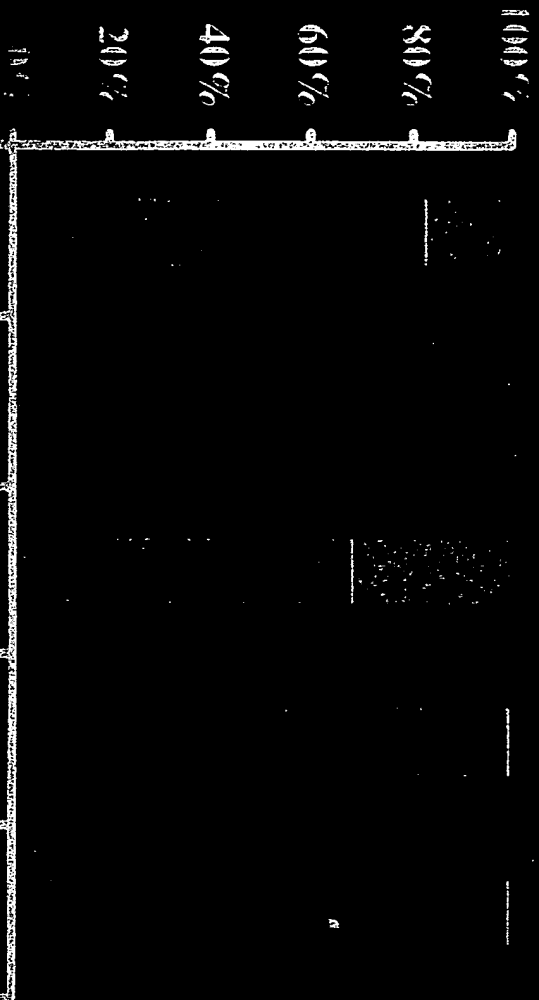


IDEASTM Bit Design: 7 7/8 ER5754



077 ER5754 results from 12 runs

CANADA





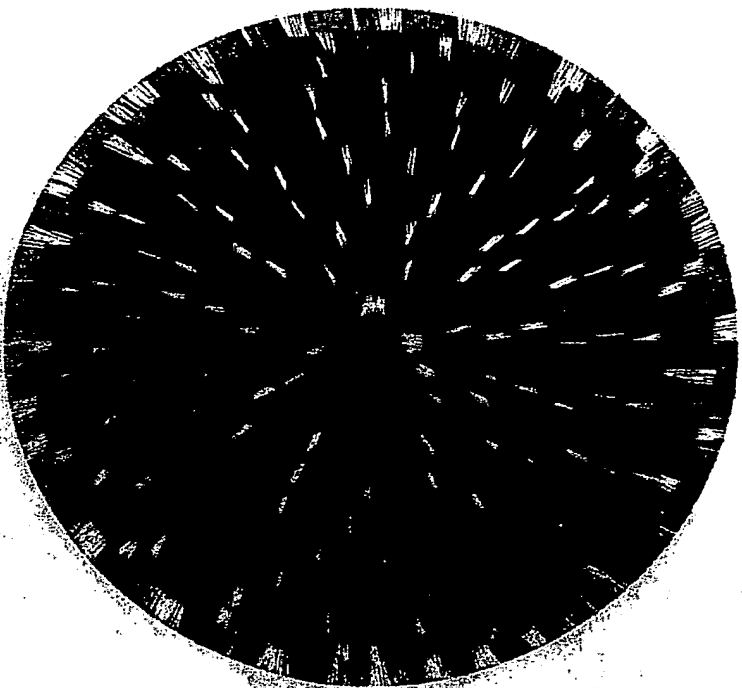
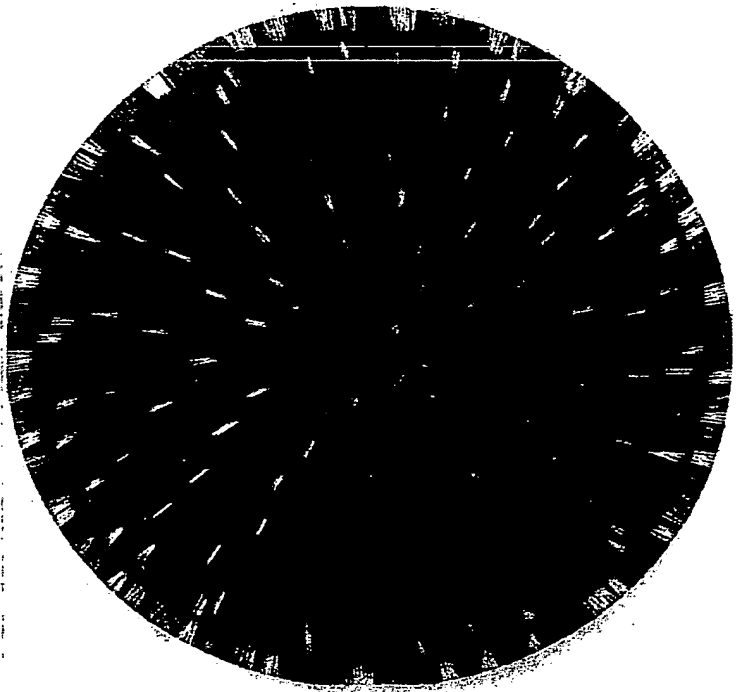
IDEAS™ Bit Design: 7 7/8 DR5897 (F47H)

- The first hard formation ideas design

	STD F47H	ER 5897
WOB	55K	55K
RPM	60	60
ROP/IDEAS	16.04	19.26
Rock Type	Shale	Shale
Bit Coverage	38%	40%
Bit Offset	.125	.125
Insert Count	125	148
Row Count	12	14
Insert Ext.	.276	.313
Journal Angle	36	32.5



IDEAS™ Bit Design: 7 7/8 ER5897 (F47H)

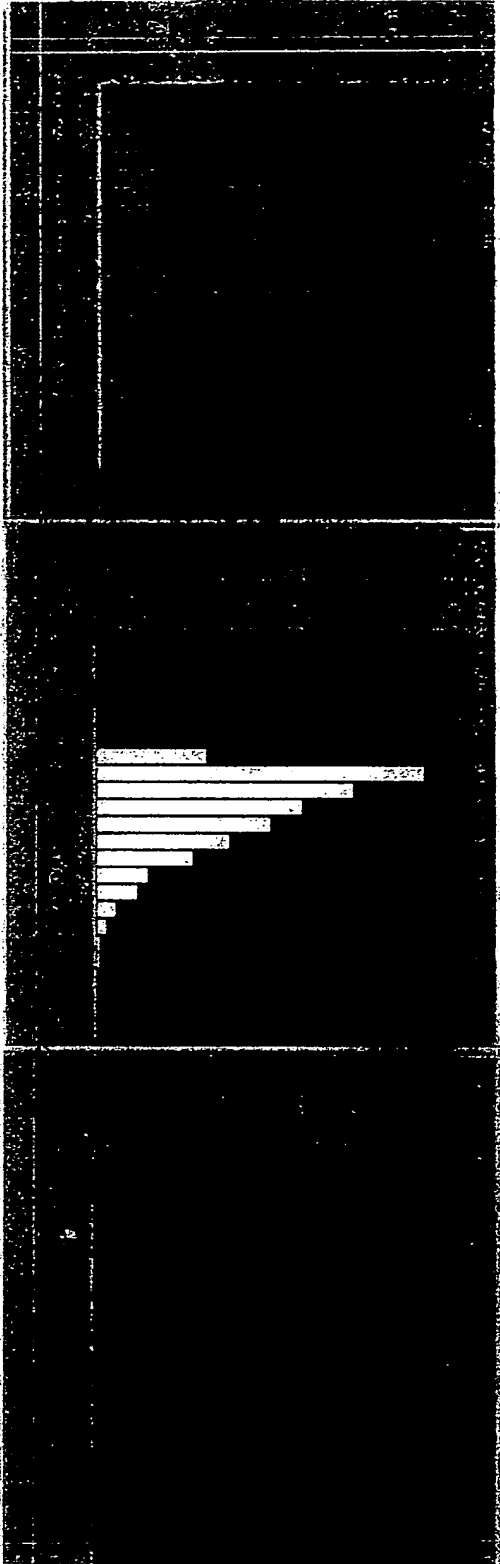


STD 077 F47H

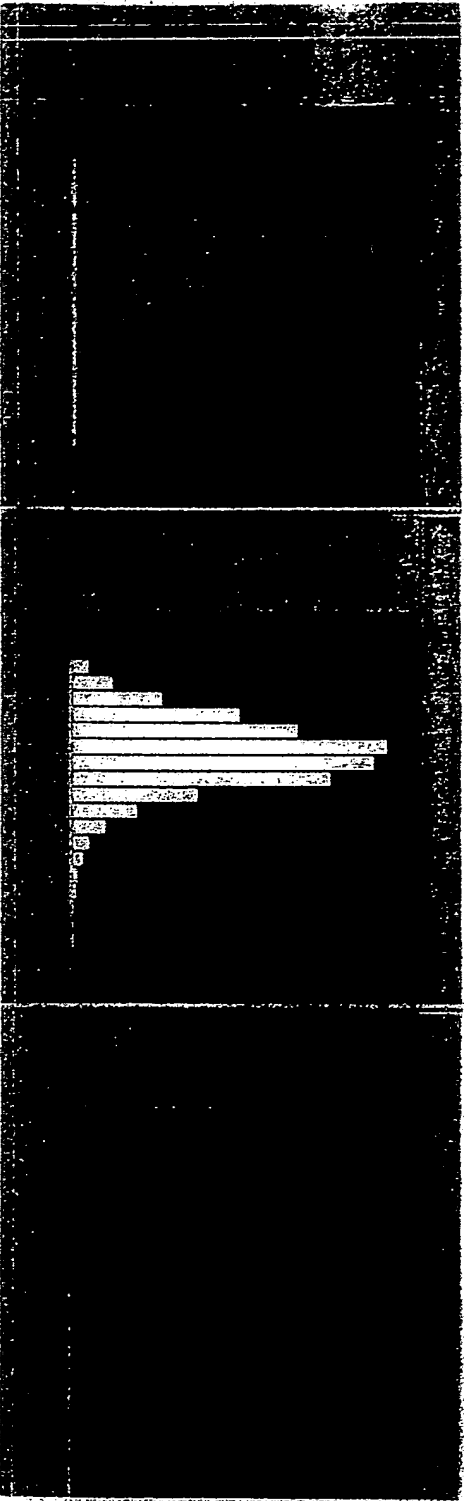
077 ER5897



SND 077 F47H

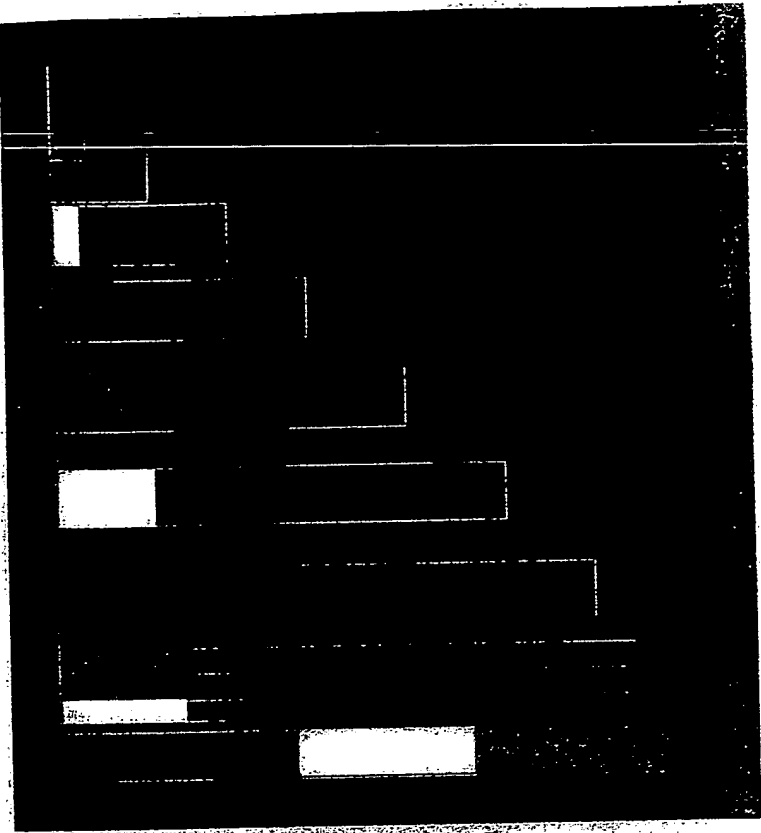


077 ER5897

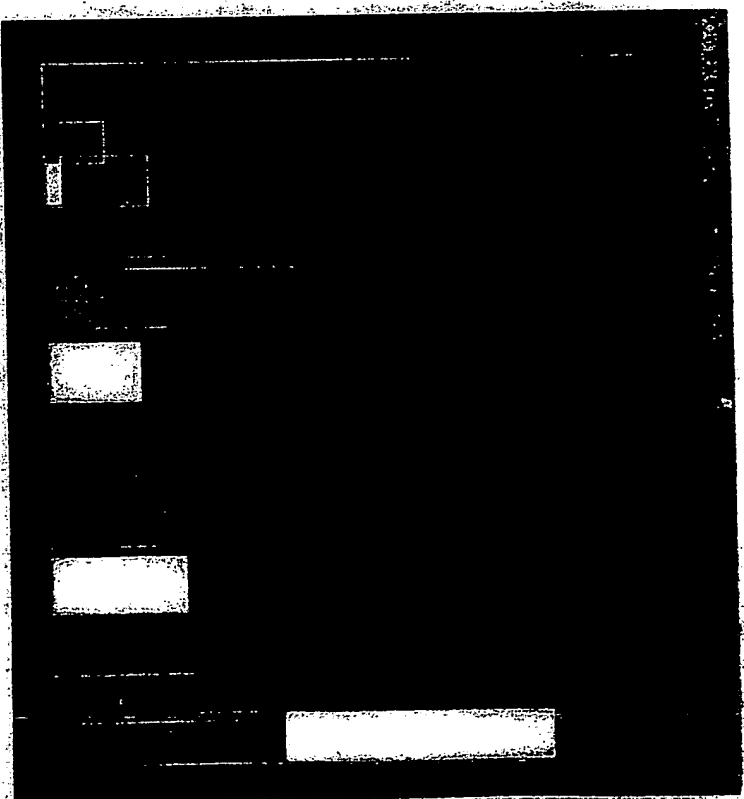


IDEAS™ Bit Design: 7 7/8 ER 5897 (F47H)

STD 077 F47H



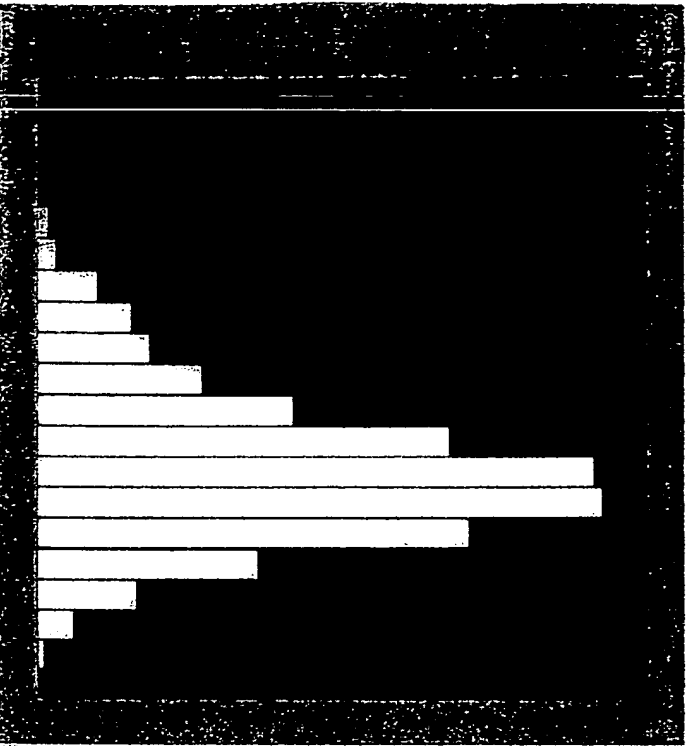
077 ER5897



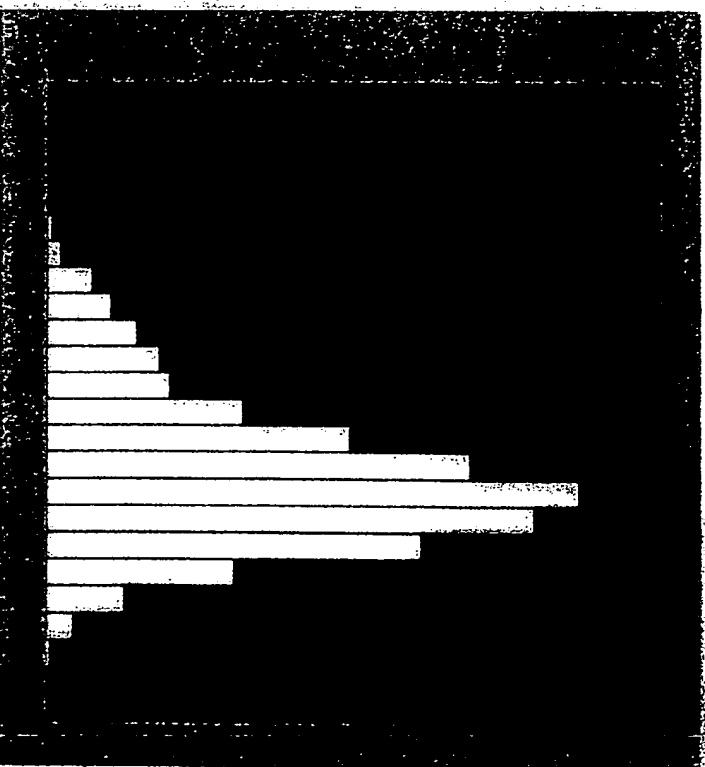


IDEAS™ Bit Design: 7 7/8 ER5897 (E47H)

STD 077 E47H



077ER5897





IDEAS™ Bit Design: 7 7/8 ER5897 (F47H)

077 ER5897 (F47H) results from 7 runs
in Rocky formation

100%							
80%							
60%							
40%							
20%							
0%							
	O'All	Dull	Obj	Feet	ROP	C/S	Brq

IDEAS Design Status

- North American TCI -

Ying's "Honor Roll"

Objective:

- * Deliver successful TCI size/types requested in the IDEAS SMP for an IDEAS product launch in North America by year end.

Milestones/Status:

Target Size/Type	ER	Status (Design Release)	Comments
7 7/8 F1/F12	5879	Field (4/27/00)	
F15/F15H	5754	Field (4/21/99)	
	5858	Field (2/2/00)	Aggressive version of 5754
F17/F27I/F27	5832	Field (3/2/00)	5754 profile
	5846	Field (12/11/99)	New profile
	5924	Field (4/27/00)	Based on 5832 but with 616
	5929	Hold	Improved durability – pending
			5929 results
F47H	5897	Field (4/27/00)	
F67	TBD	Sept. Design	
F8	TBD	TBD	

IDEAS Design Status cont'd

North American TCI -

Objective:

Ying's "Honor Roll"

Deliver successful TCI size/types requested in the IDEAS SMP for an IDEAS product launch in North America by year end.

Milestones/Status:

Target Size/Type	ER	Status (Design Release)	Comments
8 1/2 F47	TBD	August Design	32° journal angle as with 5897
8 3/4 F07Y	5778 5920	Field (6/17/99) Mfg. (5/26/00)	Hardfaced spearpoint – two section application
F15H	5928 5947 5945	Mfg. (5/26/00) July Design July Design	D-gun – same design as 5920 5858 type
F3H	5822	Field (11/15/99)	Hybrid between 5754 & 5858 Need more durable design for Williston
F47H	TBD	August Design	
F67	TBD	August Design	
F8	TBD	TBD	32° journal angle as with 5897